LSU | Center for Energy Studies
Spring 2015 *Newsletter*

www.ces.lsu.edu

Louisiana State University

Energy, Coast and Environment Building

Baton Rouge, Louisiana 70803

Phone: 225-578-4400

Fax: 225-578-4541

E-mail: ces@lsu.edu

Highlights:

LSU Launches Energy Initiative

CES Executive Director David Dismukes chairs the University's Energy Initiative Task Force, which is charged with steering a years-long initiative to encourage research partnerships with industry (see sidebar for committee members). In late 2014, the group identified LSU's current energy-related research activities and funding levels after surveying major units and colleges and reviewing research project funding undertaken by the Office of Sponsored Programs. Results show that LSU's energy-related research is impressive and spans a wide range of topics, including upstream oil and natural gas drilling and production topics (including hydraulic fracturing), geology, solar, wind, biomass, geothermal, materials, efficiency, electrical conductivity, nuclear, environmental impacts, and socioeconomic impacts.

Annual LSU energy-related research funding is estimated to have averaged from between $1.2 million to $14 million per year over the past seven years. Total energy-related funding for the past seven years is estimated to total $97.9 million over 153 separately identified projects.

The survey found that most of LSU's energy-related research during the study period has been conducted by units within the College of Agriculture/AgCenter and the College of Engineering. The Center for Energy Studies, including the Louisiana Geological Survey, has been awarded $4.5 million in externally funded research for 33 projects, more than several larger colleges and schools.

The table below summarizes total energy-related funding by major college and unit-level research institute.

Energy Initiative Task Force

David Dismukes, Chair
Center for Energy Studies

James A. Richardson, Co-Chair
E. J. Ourso College of Business

Committee members:

Troy C. Blanchard
College of Humanities & Social Sciences

John Day
School of the Coast & Environment

Emily Frank
LSU Libraries

Keith B. Hall
LSU Law Center

Robert Holton
College of Art & Design

Gus Kousoulas
Office of Research & Economic Development

Amy L. Reynolds
Manship School of Mass Communication

John S. Russin
LSU AgCenter

Karsten Thompson
College of Engineering

Angela Webb
College of Human Sciences & Education

Carol Wicks
College of Science

College/Research Unit		Funding	Percent of Total	Number of Projects		Average Award per Project
Agriculture	$	38,642,116	39%	19	$	2,033,796
Art & Design	$	2,460,000	3%	1	$	2,460,000
Business School	$	1,257,973	1%	3	$	419,324
Center for Energy Studies	$	4,492,286	5%	33	$	136,130
Engineering	$	32,713,937	33%	52	$	629,114
School of Coast & Env.	$	12,033,649	12%	23	$	523,202
College of Science	$	6,328,234	6%	22	$	287,647
Total	**$**	**97,928,195**	**100%**	**153**	**$**	**640,054**

LSU POWER PLAYERS

On February 18, LSU's Office of Research and Economic Development, with Communications and University Relations, launched a marketing initiative to promote the University's energy research endeavors. The goal of the campaign, titled "Power Players," is to stimulate research partnerships between the University and industry. The campaign includes print ads, videos, and op-eds featuring faculty involved in energy-related fields. Several researchers, including Dismukes, are featured in Power Players video interviews and Q&As. For more on the Power Players initiative, visit the Power Players website: www.lsu.edu/powerplayers.

R.T. Dukes, senior analyst with Wood McKenzie, provided an outlook for the Haynesville Shale play in North Louisiana.

U.S. Senator David Vitter welcomes Energy Summit participants and speaks about the state's energy future.

Mike McDaniel, professional-in-residence at the LSU Center for Energy Studies, leads the roundtable discussion on Louisiana energy and the environment.

The Tuscaloosa Marine Shale play was the topic of Amelia Resources president Kirk Barrell's presentation.

Energy Summit™ 2014

On October 22, CES hosted Energy Summit™ 2014, "The Future of Louisiana Energy," drawing approximately 150 attendees, the largest turnout to date. After an opening address by Senator David Vitter, the audience heard from energy industry experts on the future of Louisiana's shale plays, wholesale power markets, industrial usage, exports, workforce and the environment. A few of the takeaways included the following:

- Although drillers in the Tuscaloosa Marine Shale have improved efficiency, drilling activity will undoubtedly be affected by low prices.
- Low natural gas prices will impact Haynesville Shale production until proposed export terminals are up and running.
- Some chemical and other manufacturers that depend on natural gas as a feedstock for an energy source oppose exports on the basis that gas prices could rise.
- Because of increased demand due to new gas-fired power plants, the manufacturing renaissance and LNG exports, some are concerned about how much natural gas will be available to meet the growth in demand.
- By 2030, the price of natural gas is predicted to hit about $10 per thousand cubic feet.

LSU
POWER PLAYERS

Todd Hillman, vice president for Mid-Continent Independent System Operator (MISO), talks about the outlook for regional wholesale power markets.

Bill Davis, who serves as project executive for Golden Pass Products, ExxonMobil, participated in the energy exports panel discussion.

Jennifer Vosburg, senior vice president of NRG Energy and president of Louisiana Generating, answers an audience member's question.

Stephen Barnes, Director of the Division of Economic Development, LSU E.J. Ourso College of Business, discusses the outlook for Louisiana's energy workforce.

Holly Houk Cullen, assistant vice chancellor, and Todd Miller, director of communications, LSU Office of Communications and University Relations, promote the Power Players initiative. Here they discuss potential research opportunities between the University and the energy industry with a participant at Energy Summit™ 2014.

Richard Metcalf, director of environmental affairs at the Louisiana Mid-Continent Oil & Gas Association, participates in a panel discussion on the future of Louisiana energy and the environment.

Deniese Palmer-Huggins, senior energy adviser with the BEG Center for Energy Economics at the University of Texas, provides insight on the future of Louisiana industrial usage and development.

View or download Energy Summit™ presentations at www.enrg.lsu.edu/Conferences/energysummit2014/presentations.html

All photos by Brian Baiamonte

Louisiana Geological Survey Update

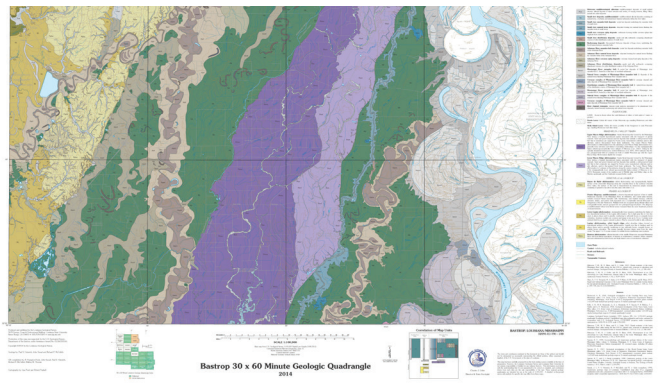
LGS Performs Analysis of State Sand Resources, Suitability for Hydro-Fracturing

LGS recently conducted a preliminary study of sand resources in four areas to determine its suitability for use in hydraulic fracturing and to assess its potential for economic development. The sand would serve as proppant, particles mixed with fracturing fluid to hold fractures open after a hydraulic fracturing treatment. Samples were collected in the Catahoula sandstone near Sicily Island and from the Amite River Basin. After laboratory analysis, it appeared that all of the samples analyzed were on the borderline of acceptance for use as proppant. A research poster was presented at the GCAGS Conference October 5-7, 2014, in Lafayette. Initial findings of the study were also reported in the *AAPG Explorer* (September 2014) in an article by Louise Durham titled "Getting Down to the Nitty Gritty of Fracturing." LGS intends to expand the initial study into a statewide investigation.

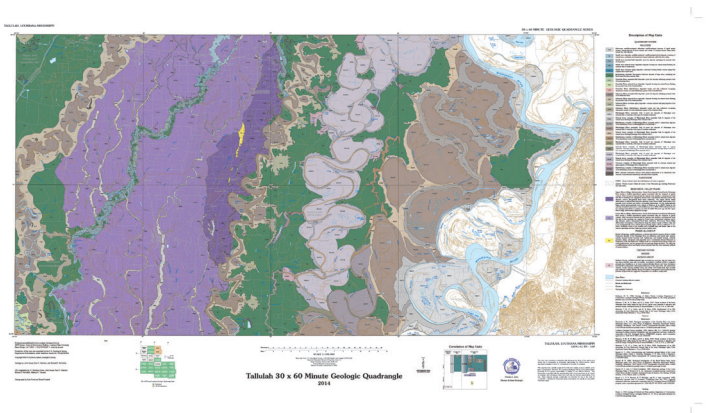
Aimwell, Louisiana pit
La Salle Parish

Geologic Mapping

The Louisiana Geological Survey's production of lithographs of 30×60 minute geologic quadrangles continued with two quadrangles in the northeastern corner of the state (Bastrop and Tallulah). These data were previously compiled with USGS STATEMAP support.



Bastrop 30 x 60 Minute Geologic Quadrangle
2014



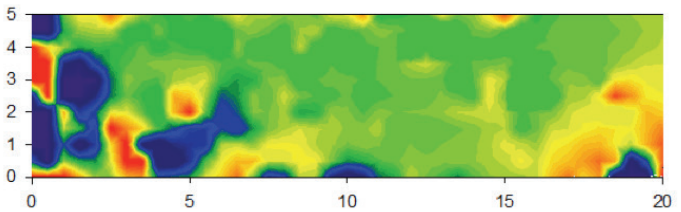
Tallulah 30 x 60 Minute Geologic Quadrangle
2014

LGS Surveys Archeological Sites

LGS recently conducted geophysical field surveys in localities of archeological interest using techniques that can be applied to the more modern issues of near-surface stratigraphy, soil engineering properties, pipeline locations, lost boundary markers, and water-table depths. For the survey, electrical resistivity measurement and geomagnetometry were used to search for anthropogenic artifacts that include remnants of building structures and cemetery burials that are currently concealed by flood sediment, topsoil, and vegetative cover. In most instances the presence of such features is inferred from old maps or existing physical markers, such as fences and monuments, while in some situations the information is almost entirely anecdotal with few or no reliable markers. These geophysical investigations have produced useful results and suggest improvements in future survey strategy and data processing.

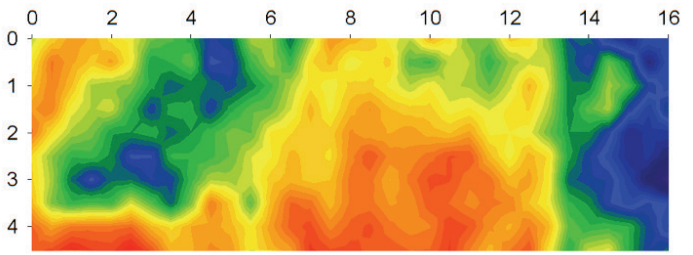
These techniques can be applied to the more modern issues of near-surface stratigraphy, soil engineering properties, pipeline locations, lost boundary markers, and water-table depths.

One study attempted to locate an abandoned cemetery noted on early twentieth century survey maps (near Empire, La.), but at present lacks markers or monuments of any kind. While resistivity data were inconclusive, gradiometer data show a pattern of recti-linear anomalies in a location consistent with map indications of a cemetery.



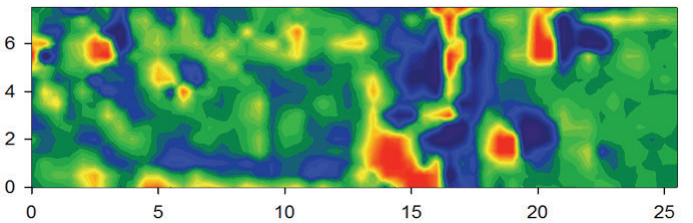
Magnetic gradometer map (scales in meters) of study area near Empire, La., shows rectilinear anomalies corresponding to an area of burials noted on a ca. 1924 property survey map.

Conversely, in a field study of Highland Cemetery near the LSU campus, a map of subsurface electrical resistivity shows areas of anomalously low resistivity that correlate to areas of suspected burials, whereas magnetometer measurements were rendered ineffective in the burial search by the abundance of unimportant metal "garbage" associated with modern fencing and signage.



Electrical resistivity map of a portion of Highland Cemetery near LSU (scales in meters) shows areas of low electrical resistivity (yellow-red) corresponding to areas of suspected burials.

In a third study at Fort Pike State Historic Site near New Orleans, a gradiometer survey revealed the foundational footings of a (no longer extant) brick structure that once housed military personnel and supplies during the Revolutionary and Civil Wars .



Gradiometer map of a portion of Ft. Pike Historical Site near New Orleans (scales in meters) weth rectilinear anomalies (shades of light green to red) corresponding to wall footings of brick structures no longer standing.

LGS continues to improve these field techniques and apply them to archeological sites such as cemeteries, battlefields, and plantation homesteads in the search for known or suspected artifacts.

Minerals Processing Division Update

Emissions Prediction Model Completed

CES's Minerals Processing Division, or MPRD, led by Ralph Pike, recently completed an emissions prediction model utilizing the well-known GRI-Mech 3.0. The model can predict emissions from energy sustainability systems including cogeneration systems and combustion-based biomass conversion systems. The model will be made available soon at www.mpri.lsu.edu.

Project to Determine Resiliency of Chemical Industry along Mississippi River

MPRD has recently begun a project to improve the resilience of the infrastructure of the Chemical Processing Industry (CPI). The project will use and further develop a chemical production complex based on multiple plants in the lower Mississippi river corridor, from below New Orleans to Baton Rouge, to evaluate the capability of the complex to absorb and recover from adverse events and the impact of these events on the supply chain of critical chemicals. The chemical industry is one of the 16 critical infrastructures identified in policy guides to improve the nation's resiliency from executive orders and presidential policy directives (DHS, 2014).

New Process Safety Course Available

The Division is nearing completion of a new professional development course on Layer of Protection Analysis (LOPA), which will be available at www.mpri.lsu.edu. This self-study course adds to and complements other process safety related courses available. Layer of Protection Analysis is used as an extension of HAZOP analysis to identify potentially hazardous events using independent layers such as standard operating procedures, process control systems alarms with defined operator response, and safety instrumented systems. LOPA is used to evaluate scenario risk and compare it with risk tolerance criteria to decide if existing safeguards are adequate, and if additional safeguards are needed. Results from recent safety research are included to show industry applications.

Pike, Sengupta Chair Panels

Ralph Pike and Debalina Sengupta, research associate at Texas A&M University, chaired three technical sessions at the American Institute of Chemical Engineers' Annual Meeting in Atlanta, November 16-21, 2014. Each session included eight presentations from industry engineers and university researchers on numerous aspects of developing innovative processes to produce fuels and chemicals from renewable resources. The sessions were "Sustainable Fuels: Advances in Innovative Processes," "Sustainable Chemicals: Advances in Innovative Processes," and "Sustainable Fuels from Renewable Resources."

Wang Participates in LIFT2 Project

Wei-Hsung Wang, associate professor, Center for Energy Studies, and director, LSU Radiation Safety Office, along with Guang Jia and Kenneth Matthews, both associate professors in the Department of Physics & Astronomy, have recently participated in a Leverage Innovation for Technology Transfer 2, or LIFT2, project to revolutionize industrial air purifiers. Wang's primary role in the project is to ensure that the radiation-producing equipment is adequately shielded to reduce radiation exposure to as low as is reasonably achievable.

The $22,145 grant, awarded to the investigators last summer, allowed the radiation physicists to build a prototype air filter that uses a low-energy X-ray to ionize pollutant particles traveling through an industrial chimney. Electrode collecting plates then retain the particles instead of allowing them to be released into the atmosphere. This novel design is considered highly marketable due to its flexibility to be modified.

"We can design it using a different energy X-ray and different power based on the chimney size and also based on the chemical composition of the pollutant," Jia said. "We can fine tune the X-ray energy, so you can individualize it."

The LIFT2 Grant Program was created by the LSU Board of Supervisors to help "Leverage Innovation for Technology Transfer" across all campuses of the LSU System with the goal of bringing academic research to market. A total of 15 grants were awarded.

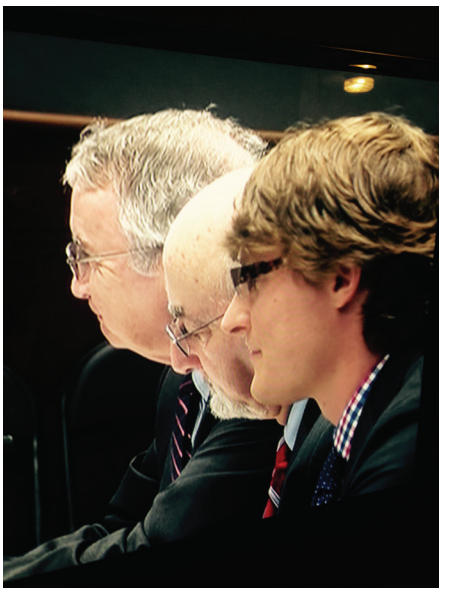
Upton Contributes to State Fiscal Study

Greg Upton, CES assistant professor, has authored a chapter on minerals revenues in a study titled *The Louisiana Fiscal Structure, 2014,* edited by James A. Richardson, LSU professor of economics, and Gregory V. Albrecht, chief economist for the Louisiana Legislature.

The chapter, titled "Louisiana Mineral Revenues," provides an overview of the current tax structure and a history of minerals revenues in the state and provides estimates of tax revenues under different future production, price and tax regime scenarios. It recommends that the state

- levelize the different tax rate for oil and natural gas such that both are taxed at the same rate while achieving revenue neutrality.
- changes the tax structure to eliminate differential treatment of horizontal and vertical wells by leveling exemptions on all wells
- create a permanent fund by designating severance tax revenues associated with new shale plays to mitigate the state's dependence on volatile yearly revenues while creating a financial asset for the future generations of Louisianans.

The study will be available in May of 2015.



Jim Richardson, LSU professor of economics, Steven M. Sheffrin, Tulane professor of economics, and Greg Upton, CES assistant professor (l-r), appeared before a joint meeting of the Louisiana House Ways & Means and state Senate Revenue & Fiscal Affairs committees on March 10, 2015, to provide a preview of The Louisiana Fiscal Structure, 2014.

CES Presentations

Recent presentations available online

By Mike McDaniel

"What Louisiana Can Expect from EPA's Recently Proposed Revisions to the National Ambient Air Quality Standards for Ozone," Air & Waste Management Association, Louisiana Section, January 15, 2015.

By David Dismukes

"Natural Gas Leveraged Economic Development in the South," Southern Governors Association Meeting, August 16, 2014.

"Unconventional Development & Energy Independence," 2014 SONRIS to Sunset Annual Conference, Louisiana Department of Natural Resources, August 27, 2014.

"Unconventional Oil & Natural Gas: Overview of Resources, Economics & Policy Issues," Society of Environmental Journalists Annual Meeting, New Orleans, September 4, 2014.

"Overview EPA's Proposed Clean Power Plan and Impacts for Louisiana," Clean Cities Coalition Meeting, November 5, 2014.

"Energy Prices and the Outlook for the Tuscaloosa Marine Shale," Baton Rouge Rotary Club, January 28, 2015.

Dismukes Discusses Oil Prices, Tuscaloosa Marine Shale at January Rotary

At the January 28 meeting of the Rotary Club of Baton Rouge, David Dismukes said that share prices for publicly traded Tuscaloosa Marine Shale operators had fallen considerably.

David Dismukes, CES executive director, presented "Energy Prices and the Outlook for the Tuscaloosa Marine Shale," to the Rotary Club of Baton Rouge, Wednesday, January 28, 2015. In his presentation, Dismukes said that most analysts agree that oil prices are unlikely to rebound very far from their current sub-$50 level for at least another year or so. Dismukes said that oil prices are expected to remain below the $100 level into 2016 and 2017. According to market predictions, the price will remain at less than $65 for the next year or more.

While the level of drilling for crude will not be impacted significantly in Louisiana, oil service companies could stand to lose some ground. Activity in the Tuscaloosa Marine Shale play, the most expensive unconventional play in the country, is likely to drop as long as the price of oil is below approximately $80.

As for the announcement in January that Sasol Ltd. would delay its gas-to-liquids plant near Lake Charles, Dismukes said that it is the difference between the price of oil and natural gas that determines the profitability of the operation.

The oil price decline could also negatively affect the region's natural-gas dependent chemical industry. Lower oil prices reflect weak growth in Asia, which means a weaker international market for products produced by Louisiana plants, he said.

Dismukes expects to see an uptick in natural gas prices as crude oil drilling activity lessens because much of the more recent natural gas production has been a byproduct of crude oil drilling. In term of the effect of oil and gas prices on the announced manufacturing activity in the region, Dismukes predicts that companies will have to reevaluate those expansions and projects.

"The same things making oil prices drop will be the same things that will challenge those chemical projects," he said.

Energy-leveraged Economic Development Topic of Southern Governors Talk

Most of the economic opportunities arising in energy-based manufacturing will be concentrated in few areas of the country, with the South being one of those preferred regions, according to a report by David Dismukes, presented at the annual Southern Governors' Association conference in Little Rock on August 16, 2014. Dismukes explained that energy-based manufacturing differs from traditional manufacturing in that it tends to pay considerably higher wages and uses energy in a variety of sophisticated ways, the most important of which is as a feedstock for other products, fuels, and energy resources.

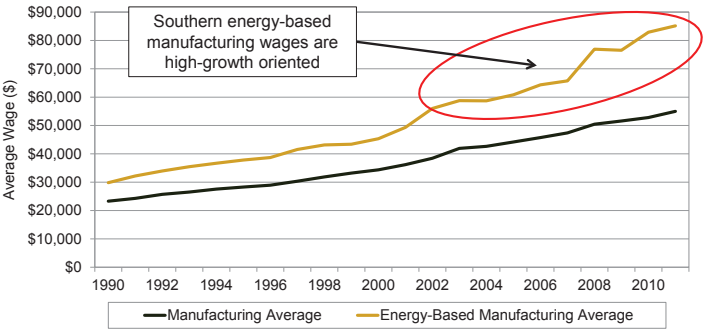
"Abundant natural gas supplies have led to the development or announcement of more than $65 billion in new capital expenditures," Dismukes said. "Demand for the output from these energy manufacturing facilities is not relegated to the U.S. or North American market, but extends world-wide, particularly to the growing economies of Asia, some of which are experiencing growth rates for the commodities and products produced at these facilities at levels double to triple those in the U.S."

Dismukes cautioned, however, that securing in-state investment in new energy-based manufacturing will become increasingly more competitive, even for states like Louisiana and Texas that have, to date, held a competitive advantage in new project announcements.

"Developers are increasingly exploring other locational opportunities," he said. "The key to new energy manufacturing investment often rests with any individual state's business climate, the stability of its regulatory environment, and its willingness to facilitate the development of transmission and distribution assets needed to move new energy supplies to locations that could support energy manufacturing."

Southern Manufacturing Wages vs. Southern Energy-Based Manufacturing Wages

Energy-based manufacturing wages in the South are higher than the average manufacturing wage. In 2012, the average energy-based manufacturing wage was 1.5 times that of the average manufacturing wage growing at average annual rate of 5.2 percent (compared to the manufacturing average of 4.2 percent)



Note: Energy-based manufacturing includes: petroleum and coal products; chemical; and plastics and rubber products manufacturing.
Source: Bureau of Economic Analysis, U.S. Department of Commerce.

Visit www.enrg.lsu.edu/presentations
to view or download CES presentations.

CES Meets World

The Center assisted with the University's international relations when David Dismukes met with representatives from several nations who were interested in learning about Louisiana's energy industry. In August, Dismukes and Karsten E. Thompson, professor and department chair, Craft & Hawkins Department of Petroleum Engineering, participated in the **U.S.-Israel Energy Summit** in New Orleans, which was organized to create opportunities for Israeli students at Gulf Coast universities and in industry, encourage Gulf Coast scientists and engineers to teach in the Israeli programs, foster joint research of Israeli and American scientists and engineers and advance joint projects such as NSF-BSF and exploration of the East Mediterranean.

In October, **Argentine MBAs** with an interest in oil and gas visited campus during the American Production and Inventory Control Society conference in New Orleans. Dismukes met with the group and provided an overview of CES.

Lauren George, **Head of Science & Innovation, British Consulate-General Houston,** visited CES in January to discuss potential opportunities for research partnerships, specifically to learn how the Center engages industry, with the goal of "uniting the momentum of academia and the private sector."

In February, the **New Orleans Citizen Diplomacy Council** coordinated a State Department-sponsored visit to the Center by a delegation from Iraq. The group of eight, with three interpreters, was interested in building an energy industries workforce, sustainable energy and training, and education of all levels of oil/gas and petrochemical sector workers.

Of Note

This year's **F. Malcolm Hood Scholarship** recipient is Cara Leigh Oliver, a senior in mechanical engineering. **The Robert R. Brooksher Scholarship** recipient is **Meredith R. Lester**, senior in petroleum engineering.

David Dismukes has been asked to serve on the editorial board of the journal *Utilities Policy*. His two-year term began January 1, 2015. Editorial board members receive complimentary subscriptions to the journal and may, from time to time, be invited by the editor-in-chief to review newly submitted papers.

Mark Kaiser, CES professor and director of the Research & Development Division, has published numerous articles in the *Oil & Gas Journal, Journal of Petroleum Science and Engineering, Maritime Economics & Logistics, Marine Structures,* and *Engineering Economist*. Topics include the cleanup of Gulf structures after five major hurricanes, north Louisiana drilling costs 2007-12, a Haynesville outlook, and lease sales and Gulf OCS revenues. CES Research Associates **Sid Narra** and **Yunke Yu** were co-authors on three articles. For a full bibliography, visit http://www.enrg.lsu.edu/publications

CES Assistant Professor **Greg Upton** presented a paper titled "The Impact of Accelerated Infrastructure Replacement Programs on Natural Gas Leaks" at the Southern Economic Association meeting in Atlanta on November 24, 2014. The paper is coauthored with David Dismukes.

CES Research Associate **Brian Snyder** recently published two articles: "Solving conservation's money problems," in *Conservation Biology*, and "Tax and trade: A hybrid climate policy instrument to control carbon prices and emissions" in *Climate Policy*. Both publications are online.

At a meeting of the **Clean Cities Coalition** on November 5, 2014, David Dismukes provided an overview of the Environmental Protection Agency's proposed Clean Power Plan. The goal of the plan, which the EPA proposed in June 2014, is to reduce carbon emissions by an average of 38 percent in 2020 (interim target) and 42 percent by 2030, both from 2012 levels. The presentation is available online at http://www.enrg.lsu.edu//2014.

Zesheng Sun, CES visiting professor from the School of Economics and Management, Zhejiang University of Science and Technology, Hangzhou, China, with co-author Shuyun Wang, has published, "China's Coke Industrial and Trade Policy over 2000–2013: Its Evolution and Effects" in the *China Economic Policy Review*. The paper discusses the development of China's industrial and trade policy regarding coke and the effects of the policy over the past decade.

Photo by Brian Baiamonte

*Visit **www.enrg.lsu.edu** to read about the latest news and events at the CES.*

*The **Center for Energy Studies** conducts, encourages, and facilitates research and analysis to address energy-related problems or issues affecting Louisiana's economy, environment, and citizenry. Whether conducted by its staff or by others it supports, the Center's goal is to provide a balanced, objective, and timely treatment of issues with potentially important consequences for Louisiana.*

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Send correspondence to Marybeth Pinsonneault, communications manager, at mpinsonn@lsu.edu.

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